

**LEPYRONIA COLEOPTRATA (HOMOPTERA: CERCOPIDAE), AN
IMMIGRANT SPITTLEBUG IN NORTH AMERICA:
DISTRIBUTION, SEASONAL HISTORY, AND HOST PLANTS**

A. G. WHEELER, JR.

Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, Pennsylvania 17110.

Abstract.—*Lepyronia coleoptrata*, an Old World cercopid established in New York, Ontario, Pennsylvania, Quebec, and Vermont, is reported from 15 additional counties in Pennsylvania; records from the southern half of the state (some almost to Maryland state line) are documented as recent range extensions. New Hampshire is given as a new state record. Seasonality of a roadside population in central Pennsylvania was followed during 1988-1990. Overwintered eggs hatched in late April; adults appeared by early June and were present until late July (mid- to late August in more northern locations and at higher elevations). The seasonal occurrence is contrasted with that of two other univoltine cercopids: the native *L. quadrangularis* (Say) and the apparently immigrant *Philaenus spumarius* (L.). *Lepyronia coleoptrata* is a generalist that develops mainly on Eurasian weeds. Principal hosts at the study site were Canada thistle, *Cirsium arvense* (L.) Scop., and crownvetch, *Coronilla varia* L. A list of 25 hosts observed in Pennsylvania is included.

Key Words: Insecta, immigrant species, crownvetch, Canada thistle

Lepyronia coleoptrata (L.) is a widespread Palearctic spittlebug indigenous to most of Europe (absent from Great Britain [Ossiannilsson 1981]), northern Africa, and much of Asia, including the USSR, China, Korea, and Japan. Although recorded from North America (without specific records) by several early European workers and sometimes said to have a circumpolar distribution (Russell 1962, Hoebeke and Hamilton 1983 and references therein), this species appears to be a relatively recent addition to the Nearctic fauna. Doering (1930) did not have New World specimens when she reviewed the North American species of *Lepyronia*, and all early references to its presence in the New World remain unconfirmed.

Russell (1962), on the basis of specimens collected in 1955 and 1961, gave the first verified New World records: nine counties

in eastern New York. Hoebeke and Hamilton (1983) reported *L. coleoptrata* from Ontario, Pennsylvania, Quebec, and Vermont; additional New York records, including one from Cold Brook (Herkimer Co.) in 1940, were given. They also provided characters, including male genitalia, to distinguish this adventive cercopid from native species. In southern Canada and the northeastern United States, *L. coleoptrata* most closely resembles the common *L. quadrangularis* (Say). From that native species, *L. coleoptrata* may be recognized by having the anterior of the head broadly curved (rather than pointed at apex); by the strongly inflated frons or sucking pump, which is readily apparent in lateral aspect (see Hoebeke and Hamilton 1983: Figs. 4-5); and by the distinctly convex forewings.

Hamilton (1982) said that this species (and

other immigrant spittlebugs known in Canada) is found within a limited radius of its presumed point of introduction and is "slowly spreading northward." Populations also are spreading southward. Herein, I document its recent spread in Pennsylvania. Because data on host plants and seasonality have been nearly limited to those available in the European literature, populations in central Pennsylvania were studied during 1988–1990. Information thus obtained on seasonal history and hosts of *L. coleoptrata* is given.

This paper is dedicated to the memory of Donald R. Whitehead, a valued friend and colleague. Insects adventive in the New World fauna were among Don's many entomological interests, and we co-authored two papers on this subject (Wheeler and Whitehead 1985, Whitehead and Wheeler 1990). He brought characteristic incisiveness to bear on conceptual issues in biogeography and to analyze the status—adventive vs. indigenous—of certain New World insects.

METHODS

To help determine the current distribution of *L. coleoptrata* in Pennsylvania, roadside vegetation was swept with a standard insect net. Collections of adults (and observations of nymphs) were made in many areas of the state, and voucher specimens are deposited in the insect collections of Cornell University (CUIC) and the Pennsylvania Department of Agriculture (PDA).

The host range of this cercopid was assessed by looking for spittle masses, mainly on roadside plants but also on plants growing in various ruderal habitats. Late instars removed from spittle could be recognized as *L. coleoptrata* from the brief description in Hoebeke and Hamilton (1983) and Ossiannilsson's (1981) illustration and description of the last instar. The characteristic black markings on the head and thorax distinguish late instars of *L. coleoptrata* from those of the meadow spittlebug, *Philaenus*

spumarius (L.), and the less frequently encountered *L. quadrangularis*.

Seasonal history of a large population was followed in Lebanon Co., Pennsylvania, along interstate highway 81 (east side of the northbound lanes); the site, near milemarker 94, is in Swatara Township, 4 km south of the Schuylkill Co. line, elevation about 185 m. This site was chosen because of the density of *L. coleoptrata* populations and because the meadow spittlebug, so abundant along the highway less than a kilometer away, was present only in low numbers.

Collections and observations were made periodically in June 1988, and weekly collections (number of individuals not standardized), from late May to mid-June 1989. In 1990, standardized collections were taken weekly from late April (when spittle masses were first observed) until late June (when adults predominated), and supplemental observations, in early June to determine the appearance of adults. On each sample date, 20 nymphs were collected from crownvetch (*Coronilla varia* L.), one of the principal host plants, and preserved in 70% ethanol. Often 20 nymphs could be collected from a single plant, but generally only 1–3 were taken from one host individual. Measurement of head capsule widths in the laboratory and use of Dyar's law indicated 5 nymphal instars, typical of cercopids (Hamilton 1982). Once adults were detected, the relative proportion of late instars to adults was estimated in the field (no counts of adults were made).

RESULTS

Distribution.—Hoebeke and Hamilton (1983) gave records of *L. coleoptrata* from 10 counties in northern Pennsylvania, based on specimens I collected and several that resulted from the USDA-APHIS "High Hazard Pest Survey" program. The following records are available for 15 additional Pennsylvania counties (AGW collector), including those from southern Lancaster County near the Maryland state line (Fig. 1): Centre Co., Scotia Barrens, 25 June and

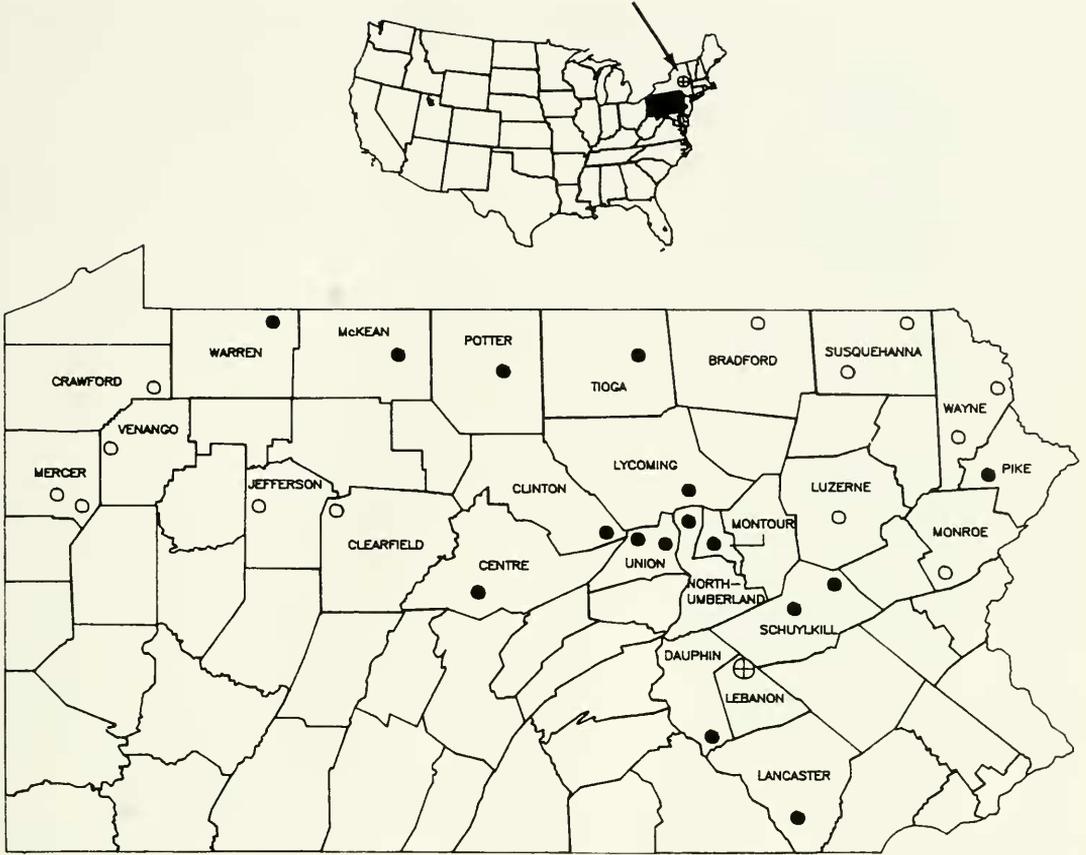


Fig. 1. Known distribution of *L. coleoptrata* in Pennsylvania; dots = new records, circles = records from Hoebeke and Hamilton (1983), and plus in circle = main study site. North American map (Pennsylvania darkened) shows site of first New World collection (Herkimer Co., New York, at arrow).

20 Aug. 1988; *Clinton Co.*, Rt. 880 N. of Carroll, 22 June 1988; *Dauphin Co.*, Rt. 283, Londonderry Township E. of Middletown, 28 June 1988; *Lancaster Co.*, Smithville and Willow Street, 15 June 1988; *Lebanon Co.*, Rt. 81, 2.6 mi. (4 km) S. of Schuylkill Co. line, Apr.–July 1988–1990 (main study site); *Lycoming Co.*, Rt. 180 nr. junc. Rt. 54 near Muncy and Rt. 180 near Faxon, 22 July 1988; *McKean Co.*, East Smethport, 16 Aug. 1988; *Montour Co.*, Rt. 54 S. of Washingtonville, 22 July 1988; *Northumberland Co.*, Rt. 80 NE. of Watsonstown, 22 July 1988; *Pike Co.*, Rt. 84 nr. junc. Rt. 390 near Promised Land State Park, 15 July 1989; *Potter Co.*, E. of Sweden Valley, 16 Aug. 1988; *Schuylkill Co.*, Rt. 81

S. of Frackville, 24 June 1987 and near McAdoo, 14 June 1988; *Tioga Co.*, Mansfield, 16 Aug. 1988; *Union Co.*, Rt. 80 at exit 29 nr. Lick Run, and West Milton, 22 July 1988; *Warren Co.*, Russell, 12 June 1986.

A new state record for *L. coleoptrata* is NEW HAMPSHIRE: *Grafton Co.*, Lebanon, 26 June 1990, AGW.

Host plants.—Table 1 lists the species on which nymphs of *L. coleoptrata* were observed in Pennsylvania. Plants at the main study site that were most often used as hosts and supported the largest populations were crownvetch and Canada thistle, *Cirsium arvense* (L.) Scop. Spittle masses containing late instars were particularly noticeable on stems of Canada thistle. Some terminals

Table 1. Hosts of *Lepyronia coleoprata* in Pennsylvania.

Plant Species	Common Name
Asclepiadaceae	
<i>Asclepias syriaca</i> L.	common milkweed
Asteraceae	
* <i>Achillea millefolium</i> L.	yarrow
* <i>Centaurea maculosa</i> Lam.	spotted knapweed
* <i>Chrysanthemum leucanthemum</i> L.	oxeye daisy
* <i>Cirsium arvense</i> (L.) Scop.	Canada thistle
* <i>C. vulgare</i> (Savi) Tenore	bull thistle
<i>Conyza canadensis</i> (L.) Cronq.	horseweed
<i>Erigeron philadelphicus</i> L.	daisy fleabane
<i>Eupatorium perfoliatum</i> L.	boneset
* <i>Hieracium pratense</i> Tausch	yellow hawkweed
<i>Solidago</i> sp.	goldenrod
Brassicaceae	
* <i>Barbarea vulgaris</i> R. Brown	yellow rocket
* <i>Brassica nigra</i> (L.) W. Koch	black mustard
* <i>Lepidium campestre</i> (L.) R. Brown	field pepperweed
Caryophyllaceae	
* <i>Cerastium vulgatum</i> L.	mouse-ear chickweed
* <i>Silene alba</i> (P. Mill.) Krause	white campion
Fabaceae	
* <i>Coronilla varia</i> L.	crownvetch
* <i>Medicago lupulina</i> L.	black medic
Hypericaceae	
* <i>Hypericum perforatum</i> L.	common St. John'swort
Onagraceae	
<i>Oenothera biennis</i> L.	common evening-primrose
Polygonaceae	
* <i>Rumex crispus</i> L.	curly dock
Ranunculaceae	
<i>Clematis virginiana</i> L.	virgin's bower
Rubiaceae	
* <i>Galium aparine</i> L.	cleavers, catchweed bedstraw
Salicaceae	
<i>Populus</i> sp. (sprouts)	aspen
Scrophulariaceae	
* <i>Verbascum thapsus</i> L.	mullein

* Eurasian species naturalized in the North American flora.

harbored 4–5 large spittle masses, each with 3–5 nymphs. Spotted knapweed, *Centaurea maculosa* Lam., was absent from roadside vegetation at the study site but was a common host in other areas. Even after adults emerged from spittle masses, exuviae sometimes could be seen attached to terminal stems of heavily infested plants. The cast skins retain the characteristic black (or at least dark) markings on the head and thorax.

As already noted, only small populations

of the meadow spittlebug were present at the main study site. Canada thistle sometimes supported spittle masses of both cercopid species, but meadow spittlebugs were never observed on crownvetch during 1988–1990. They also were not associated with this plant in other areas of the state, even when heavily infested herbaceous hosts were growing in crownvetch colonies. In a state-wide survey of crownvetch arthropods, the polyphagous meadow spittlebug was among

known legume feeders conspicuously absent from the fauna associated with this plant (Wheeler 1974).

Many of the hosts listed for *L. coleoptrata* in Table 1 are known hosts of the meadow spittlebug (Weaver and King 1954). At several sites in Pennsylvania, their host ranges not only overlapped on Canada thistle but on other naturalized Eurasian composites: *Achillea millefolium* L., *Centaurea maculosa*, *Chrysanthemum leucanthemum* L., and *Cirsium vulgare* (Savi) Tenore. The spittle masses of these species occasionally were present on the same stems. In addition, the native cercopid *L. quadrangularis* was common on *Centaurea maculosa* at several sites from which *L. coleoptrata* was absent.

Seasonal history and habits.—Even though *L. coleoptrata* is said to overwinter in the egg or nymphal stage in Europe (see Ossiannilsson 1981), only eggs appear to overwinter in Pennsylvania. At the main study site, first instars were observed in late April (Fig. 2), usually occurring near ground level on stems of crownvetch or other herbs, or on the basal rosettes of mullein, *Verbascum thapsus* L. Such sites would have had low air movement and offered protection from desiccation to the newly hatched nymphs before they began to feed and secrete spittle. Five or more first instars often were present within a spittle mass.

In 1990, second instars predominated in early May and third instars in mid-May; by 30 May the population at the study area was made up of about equal numbers of third, fourth, and fifth instars (Fig. 2). In early June the population consisted mainly of fifth instars. On crownvetch stems spittle masses were still more common near ground level, but some were found in leaf axils on stems near the top of plants. On Canada thistle they frequently were abundant on terminal stems.

No adults were seen on 5 June, but two days later a teneral adult was observed. The first appearance of adults in 1990 agreed with 1988 and 1989 observations made at

the study site; on June 8 of both years, teneral adults were swept from vegetation or were observed in spittle masses on their hosts. The population still consisted mainly of fifth instars on 12 June, but adults appeared to outnumber nymphs a week later, although actual counts were not made. At a nearby site, a mating pair was observed in late June. At the sample area, adults of this univoltine species were present until late July. In northern areas of Pennsylvania and at higher elevations, adults were collected until mid- to late August.

Seasonality of *L. coleoptrata* in central Pennsylvania, based on presence of late instars and appearance of adults, was similar to that of the univoltine *Philaenus spumarius*. In some areas, however, meadow spittlebug adults were already present when only last instars of *L. coleoptrata* were found. Longevity in *P. spumarius* is greater than in *L. coleoptrata*, adults persisting into September and October. Seasonal history of *L. quadrangularis*, another univoltine species but one whose adults overwinter (Doering 1922, Garman 1923), lagged considerably behind that of *L. coleoptrata* or *P. spumarius*. Last instars or teneral adults were present along roadsides in late July, or about the time adults of *L. coleoptrata* die.

No natural enemies of *L. coleoptrata* nymphs were observed. In 1989 and 1990 the drosophilid *Scaptomyza pallida* (Zetterstedt) was associated with spittle masses on stems of Canada thistle and crownvetch. Eggs were found under spittle in early June (1989) and larvae in late June (1990). Unlike cercopid-associated members of the drosophilid genus *Cladochaeta*, which are believed to be parasites of the nymphs rather than inquilines in the froth (D. Grimaldi, pers. comm.), the *Scaptomyza* larvae were observed only in spittle. They may have fed on microorganisms present in spittle or entrapped dead insects, or possibly on decaying stem tissue near spittle masses.

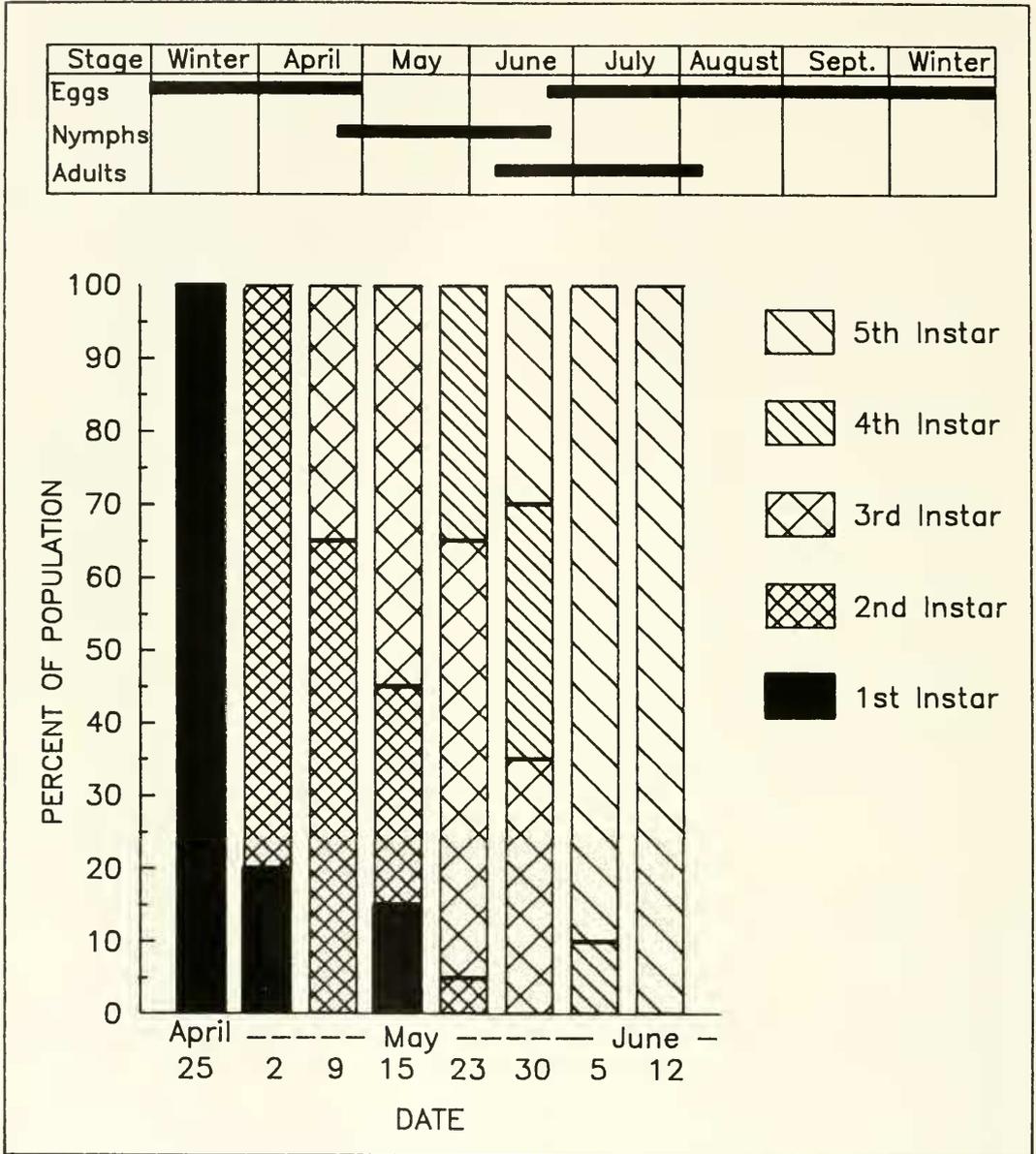


Fig. 2. Seasonal history of a central Pennsylvania population of *L. coleoptrata* studied in 1990; a generalized seasonality is shown above.

DISCUSSION

The presence of immigrant insects in North America often goes unnoticed for many years and, after eventual discovery, their spread usually is not followed. Exceptions are phytophagous species causing eco-

nomie loss at the time of detection, for instance, the cereal leaf beetle, *Oulema melanopus* (L.) (Castro et al. 1965), or those judged to pose a significant agricultural threat. When detected, innocuous insects or species of slight economic importance may

be so well established that determining their biogeographic status is impossible. Available evidence may suggest they are actually native in the North American fauna.

Lepyronia coleoptrata, whose presence in North America was verified more than 20 years after the first specimen was collected, had not undergone rapid dispersal. It represents a clear-cut immigrant, fitting nearly all tests of such status (Lindroth 1957, Whitehead and Wheeler 1990). Present in New York since at least 1940, this cercopid appears only recently to have spread into Pennsylvania. Crownvetch, as already noted, is now one of its principal host plants in the state. No spittlebugs, however, were found on this plant during statewide surveys of its fauna in the early 1970s (Wheeler 1974). Included in that study were roadside plantings now infested with *L. coleoptrata*.

When E. R. Hoebeke called my attention to this spittlebug in the early 1980s, it already was established along several major highways in northern Pennsylvania (Hoebeke and Hamilton 1983). It is now present in the southern half of the state, including Lancaster Co. near the Maryland line. Crownvetch has been planted extensively along Pennsylvania highways for erosion control and slope stabilization (Wheeler 1974). Roadside plantings may have served as corridors facilitating the cercopid's southward spread in the state. An absence of records from the southwestern counties may simply reflect inadequate sampling, or the Alleghenies may somewhat hinder dispersal to that region.

The much inflated sucking pump and perhaps the frequent habit of feeding low on host stems, even in later instars, suggest that *L. coleoptrata* specializes on xylem; most well-studied cercopids have proved to be xylem feeders (Tonkyn and Whitcomb 1987 and references therein). As they noted, species of such habit are characterized by an enlarged postclypeal region that supports the cibarial muscles needed to suck nutrient-poor xylem sap. They pointed out that cost

in energy is greater at sites higher on the plant because of increased xylem tension and decreased nutrient levels. Although tissue specific, xylem feeders tend to be host generalists (Tonkyn and Whitcomb 1987).

Indeed, this cercopid appears to be an opportunist that includes numerous herbs in its host range. Not surprisingly, many are Eurasian weeds naturalized in the New World flora.

Lepyronia coleoptrata not only can be added to the faunal associates of crownvetch but also of Canada thistle, a noxious weed in Pennsylvania (Hill 1983) and one that has been the target of biological control efforts (e.g. Peschken 1981). Even though the high densities that sometimes occur on Canada thistle produced no obvious effects, feeding at least contributes to overall plant stress resulting from herbivore attack.

Crownvetch, which has some use in Pennsylvania as a forage for ruminant animals (Wheeler 1974), is the only crop plant that now serves as a host of *L. coleoptrata* (its populations, however, are confined to highway plantings). Attacks on crownvetch, like those on Canada thistle, do not result in noticeable injury. Yet the economic importance of this immigrant should not be dismissed. Some of the effects of feeding by the pestiferous meadow spittlebug (Mathur and Pienkowski 1967, Parman and Wilson 1982), such as loss of nutrients, could easily be overlooked. Some growth disorders the meadow spittlebug and other cercopids cause could be attributed to various factors or, if suspected to be spittlebug induced, would be demonstrable only through careful investigation.

Lepyronia coleoptrata may remain almost restricted to weeds growing along highways or in ruderal sites. But perhaps its use of crownvetch may become increasingly important as a means of avoiding possible competition with the ubiquitous meadow spittlebug. Because the polyphagous *L. coleoptrata* has been reported from alfalfa and cotton in Europe (see Hoebeke and Ham-

ilton 1983), it poses at least a potential agricultural threat, even if crop damage is unknown in its native environment. Continued monitoring of its spread and host use in North America seems desirable.

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